



National Transportation Safety Board Aviation Accident Final Report

Location:	SPOKANE, WA	Accident Number:	SEA96FA039
Date & Time:	01/04/1996, 1853 PST	Registration:	N358SA
Aircraft:	Convair 340	Aircraft Damage:	Destroyed
Defining Event:		Injuries:	1 Minor, 1 None
Flight Conducted Under:	Part 91: General Aviation - Ferry		

Analysis

Before the ferry flight, the pilot (PIC) & inexperienced copilot noted the left & right, float-type, underwing, fuel gauges indicated about 3,900 & 4,050 lbs of fuel, respectively. After takeoff, they noted that the cockpit gauges showed an opposite fuel imbalance of 4,100 & 3,600 lbs in the left & right tanks. Due to this indication, the PIC crossfed fuel from the left tank to both engines for about 30 min to rectify the perceived fuel imbalance. Later as they approached the destination, the left tank was exhausted of fuel, & the left engine lost power, although the left gauge indicated about 500 lbs of fuel remaining in that tank. The PIC then crossfed fuel from the right tank to both engines, & left engine power was restored. ATC vectored the flight for an emergency ILS runway 3 approach. The PIC was distracted during the approach & maneuvered the airplane to re-intercept the localizer. About 500' agl in IMC, both engines lost power. During a forced landing at night, the airplane struck a raised berm & was damaged. No evidence of fuel was found in the left tank; 125 gal of fuel was found in the right tank. Unusable fuel was published as 3 gal. During an exam of the engines & fuel system components, no preimpact failure was found. Historical data from the manufacturer indicated that when the airplane had a low fuel state, unporting of fuel tank outlets could occur during certain maneuvers. This information was not in the Convair 340 flight manual, although unporting of the outlets on this flight was not verified.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: the pilot's improper management of the fuel/system, which resulted in loss of power in both engines, due to fuel starvation. Factors relating to the accident were: false indications of the cockpit fuel gauges, darkness, and the presence of a berm in the emergency landing area.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - NONMECHANICAL
Phase of Operation: APPROACH - FAF/OUTER MARKER TO THRESHOLD (IFR)

Findings

1. ALL ENGINES
2. (F) ENGINE INSTRUMENTS,FUEL QUANTITY GAGE - FALSE INDICATION
3. AIRCRAFT MANUALS - INADEQUATE
4. (C) FUEL MANAGEMENT - IMPROPER - PILOT IN COMMAND
5. INFORMATION UNAVAILABLE - MANUFACTURER
6. LACK OF TOTAL EXPERIENCE IN TYPE OF AIRCRAFT - COPILOT/SECOND PILOT
7. (C) FLUID,FUEL - STARVATION

Occurrence #2: FORCED LANDING
Phase of Operation: EMERGENCY DESCENT/LANDING

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: EMERGENCY LANDING

Findings

8. (F) LIGHT CONDITION - DARK NIGHT
9. (F) TERRAIN CONDITION - BERM

Factual Information

HISTORY OF FLIGHT

On January 4, 1996, at 1853 Pacific standard time, N358SA, a Convair 340, operated by Salair, Inc., Spokane, Washington, collided with terrain during a forced landing in Spokane and was destroyed. The forced landing was precipitated by a total loss of engine power during final approach. The first pilot received minor injuries and the second pilot was not injured. Instrument meteorological conditions prevailed and an instrument flight rules (IFR) clearance was issued. The ferry flight departed from Deer Valley, Arizona, at 1320 Pacific standard time and was destined for Spokane. The flight was conducted under 14 CFR 91.

The first pilot stated that he began his day (the day of the accident) about 0500. He flew via commercial airline cockpit jump seat from Spokane to Phoenix, Arizona, to pick up the Convair 340 and ferry it to Spokane. He stated that a "very thorough inspection" of the airplane was performed. He asked the second pilot, who had picked up the first pilot earlier that morning in Phoenix, to fuel the airplane. The airplane was fueled with an additional 647 gallons of 100 low lead aviation gasoline. The first pilot stated that the float-type, direct-reading "Boston" fuel gauges, located underneath each wing, were indicating 650 gallons (3,900 pounds) in the left wing, and 675 gallons (4,050 pounds) in the right wing, for a total indicated fuel load of 1,325 gallons. The underwing Boston fuel gauges reads in gallons, and the cockpit fuel gauges reads in pounds.

The first pilot and second pilot then started up the engines, taxied out to a run-up area, ran up the engines, and taxied back to inspect the airplane. The first pilot briefed the second pilot on all of the systems and procedures of the airplane. The crew then departed. During climbout, the engines were "running great." Fuel flows during the climb were "just perfect" at 950 pounds per hour. The airplane climbed to 6,500 feet above mean sea level (msl). Visual flight rules (VFR) weather conditions prevailed.

The first pilot stated that he opened a VFR flight plan at cruise with a destination of Mountain Home, Idaho, because the weather "was good" and the second pilot had family there. The first pilot stated that air traffic control (ATC) could not provide flight following, because the transponder was apparently not working. This anomaly surprised him, because the transponder was supposed to have been repaired at Deer Valley. The crew then overflew an airport to test the localizer. They also performed navigational airborne checks. Although the flight was VFR, the crew elected to follow airways.

The second pilot stated that they climbed to 10,500 feet initially. They checked the systems and navigational equipment. They also checked the instrument landing system (ILS) over Prescott, Arizona, and headed toward Kingman, Arizona. When they were east of Las Vegas, they "picked up another airway and headed north." The weather was "nice." They then climbed to 12,500 feet and determined they would have from 45 minutes to one hour of fuel reserves. The second pilot stated that the highest altitude that the airplane reached during the flight was 16,500 feet, at which time the crew was on breathing oxygen.

The first pilot stated that based on the winds, the flight was expected to be about 5-1/2 hours. He presumed to have 7,600 pounds of fuel on board, and planned on 1,200 pounds for the first hour, followed by 1,100 pounds for each hour afterward. The flight was about 900 nautical miles, and the first pilot planned to have 1,500 pounds of fuel after landing. He stated

that he had the second pilot perform time-speed-distance calculations during the flight, and the results for ground speed ranged from 167 knots to 180 knots.

The first pilot stated that he climbed to a cruising altitude of 14,500 feet "to stay above the clouds" as they neared Spokane, flying over Boise-Lewiston-Pullman-Spokane. He stated that he constantly evaluated his fuel situation. Based on cockpit indications, the first pilot calculated to land with just under 1,000 pounds of fuel.

The first pilot stated that he noticed a fuel imbalance on the cockpit fuel gauges when he departed Deer Valley. He remembered the left gauge reading 4,100 pounds, and the right gauge reading 3,600 pounds. This is opposite of what he remembered the Boston gauges reading. He stated that he crossfed fuel from the left tank to both engines during cruise for "maybe 30 minutes" to re-balance the fuel. The second pilot stated that the crossfeed operation lasted "one hour maximum." The first pilot also stated that he observed the left boost pump not working (as indicated by the fuel pressure gauge) when he initiated the crossfeed operation. He remembered that he told the second pilot to check the circuit breakers, which he did. He reset the circuit breaker, and the left boost pump operated normally.

The first pilot stated that they "ran out of oxygen" so they asked for an IFR clearance to descend toward Spokane. He advised ATC that he had no distance measuring equipment (DME) or transponder. The flight was cleared to 10,000 feet, then down to 9,000 feet. The first pilot remembered that the left and right cockpit fuel gauges read between 400 and 600 pounds respectively when the airplane was about 30 miles from Spokane.

The first pilot stated that the left engine fuel light came on and the left engine lost power. He felt the adverse yaw. He stated that he turned on the left boost pump in an attempt to restore engine power. Since the engine power was not restored, he opened the crossfeed valve, turned on the right boost pump, turned off the left tank, and turned off the left boost pump. He stated that this restored power to the left engine, and he verified fuel flow to the left engine from the right boost pump. No Salair checklist exists for this procedure.

The first pilot stated that he thinks the "left tank ran out of gas" because engine power was not restored when he activated the left boost pump. He notified ATC of a potential low fuel situation. He then "toggled both engines back to 1,500 RPM and 20 inches." Both engines were running at AUTO LEAN to conserve fuel. Air traffic control cleared the flight down to 4,000 feet. The cowl flaps were then closed and the first pilot briefed the approach to the second pilot. The crew was handed off to approach control and cleared to intercept the localizer for the ILS approach to Runway 3 at Spokane.

When just outside the outer marker, the crew performed the landing checklist. The first pilot stated that the "left generator overheat warning" was lit. At that point, the first pilot turned off the cockpit heater, turned off the left generator, and observed the load meter on the right generator. The generator problem was rectified. The first pilot stated that the problem caused him to deviate right of course, so he initiated a left turn to re-intercept the localizer, followed by a right turn to re-establish the airplane on course. He stated that the angle of bank to re-intercept the localizer was "no more than 30 degrees."

The first pilot then called for landing gear down and selected approach flaps. He then performed the "landing checklist." He stated that one of the items in the landing checklist was for the fuel boost pumps on. He reached up and noticed the right boost pump was already on,

so he had only to turn on the left boost pump, which is what he did. At that point, both low fuel pressure lights illuminated "about a second later." Both engines quit, and he could feel the loss of power. The first pilot said he then closed both throttles, declared a MAYDAY, selected full flaps down, immediately "put the nose down," and called for the landing gear to be raised.

The second pilot stated that the cockpit fuel gauges were reading 600 pounds on each side. The landing gear was lowered and so were the flaps.. Then, "both fuel lights went on and the engine just went dead." He stated that the first pilot then called for gear up and throttled both engines back.. The second pilot called out airspeeds to the first pilot during the forced landing. He estimated that they impacted about 75 knots. He stated that he had his hands on his lap during the flare. After the impact, he turned off the master switch.

The first pilot stated that he closed the last (right) fuel tank valve switch just prior to the impact, and the second pilot turned the master switch off after the impact. He further stated that he did not use any emergency checklists during the flight, but did use the descent/landing checklists.

The first pilot closed both throttles and force-landed the airplane in a field about one mile from the approach end of Runway 3. The airplane struck a berm and was destroyed.

The accident occurred during the hours of darkness at the following coordinates: 47 degrees, 35.85 minutes North; 117 degrees, 33.92 minutes West.

ATC COMMUNICATIONS

According to the Federal Aviation Administration (FAA) Report of Aircraft Accident and ATC transcripts (excerpts attached), the accident airplane departed Deer Valley at 1320 Pacific standard time, five hours and 33 minutes prior to the accident. At 1357, the crew contacted the Prescott, Arizona Flight Service Station (FSS) and requested weather information along their route of flight to Spokane. The FSS briefer provided the information and indicated that VFR flight was not recommended north of Elko, Nevada. The crew contacted the FSS on three more occasions for weather information from 1357 until 1409, at which time then ammended their intended routing to fly direct from Las Vegas, Nevada, then to Elko, then north of Elko to Boise, Idaho.

At 1601, two hours and 41 minutes after departure, the crew contacted the Boise FSS for a weather briefing and change in destination to Spokane. At 1759, the flight was handed off from the Salt Lake City Air Route Traffic Control Center (ARTCC) to the Seattle ARTCC. The crew reported that they were level at 16,500 feet and requested an IFR clearance. The clearance was not issued at that time. At 1806, the crew reported that they were non-DME or transponder equipped. At 1811, the crew updated their estimated time of arrival at Spokane from 1745 to 1850. At 1821, the crew requested and received an IFR clearance direct to Spokane at 14,000 feet. The crew also requested and received the lowest available altitude of 10,000 feet.

At 1838, the crew reported that they were level at 9,000 feet and requested a position. They were told that they were 32 miles south of Spokane. At 1843, the crew requested priority handling to Spokane because of a "potential emergency situation." The crew further reported that the left engine had shut down, but the fuel quantity for the left engine was indicating 800 pounds. The crew also stated that they were unsure how much fuel remained in the right engine. At 1845, the flight was handed off to Spokane Approach Control. The first pilot radioed that "the left engine [was] starved for fuel before we expected it to. We're still showing

500 pounds of fuel on the left engine's gauge.... We're now running both engines off the right and we're concerned about whether its indication is reliable or not." At 1848, the flight was cleared for the ILS runway 3 approach and told to contact the Spokane ATC Tower. Two minutes later, at an altitude of about 500 feet above the ground, the pilot declared a "mayday" because both engines suddenly quit.

AIRCRAFT INFORMATION

Basic Aircraft Description.

The accident airplane, a Convair model 340, was manufactured in 1954. It was powered by two Pratt & Whitney Double Wasp R-2800-CB16 engines, and was an all-metal, low-wing monoplane with full cantilever wing and tail surfaces. The empty weight of the airplane was 31,000 pounds, and its wingspan was 105 feet.

Fuel System Description.

The fuel system of the Convair 340 (schematics and diagrams attached) is comprised of two independent integral fuel systems, one for each engine, with a crossfeed line which may be opened to allow either engine to be supplied by the opposite tank; or both engines to be supplied by either tank. Each wing, outboard of the nacelle, has a fuel-tight compartment which serves as a 865-gallon fuel tank. The compartment in one wing is not connected with the compartment in the other wing. A line leads inboard to an electrically operated fuel boost pump in each nacelle.

Two outlets, equipped with screens, pass through the lower wing surface at the inboard end of each fuel tank. When fuel is low in the tank, one or the other of the outlets will be covered "throughout the range of normal flight attitudes of the airplane, permitting engines to draw all but 2.3 gallons for each tank," according to Tracor Flight Systems, the current type certificate holder of the Convair 340. Baffles traps are located outboard of the tank outlets to "insure coverage of the outlets in any normal flight attitude of the airplane."

A crossfeed line, fitted with two valves operated electrically and simultaneously by a crossfeed switch on the fuel control panel, crosses from one nacelle to the other and interconnects the two fuel lines downstream from the boost pumps.

The boost pump on either side is thus able to help feed fuel to the opposite engine during crossfeed operation, as well as to its own engine, as required. An electrically operated main fuel shutoff valve is installed in each nacelle upstream from the boost pump. Each engine has an engine-driven fuel pump. A fuel quantity gauge for each tank and dual indicating fuel flow meters and fuel pressure gauges are provided on the engine instrument panel.

Normal operating fuel pressure range is 21 to 23 pounds per square inch (psi), with desired pressure 21 psi and minimum idling pressure 14 psi. The boost pumps are intended to be used when starting, when at an altitude of 10,000 feet or over, or whenever fuel pressure fluctuation occurs. Company policy also requires the use of boost pumps for takeoff and landing. There is no company policy regarding the use of boost pumps for crossfeed operation. According the Tracor Flight Systems, nothing can be found in either the Convair 340 or 440 FAA approved flight manuals requiring boost pumps for crossfeed operation. Boost pumps are required, however, for operations above 10,000 feet msl.

The cockpit fuel quantity gauges are of the electronic, internally-mounted probe type. Four such units are installed in each wing tank, wired in parallel, in order to keep error due to

change in normal airplane flight attitude to within 3 percent. A fuel compensator also is installed at the inboard end of each tank in order to minimize change in dielectric constant of fuel, thus resulting in more accurate fuel gauge readings. The system operates on 115-volt, 400-cycle alternating current power. The two quantity indicators are calibrated in pounds of fuel, from zero to 5,500 pounds.

Maintenance History.

The accident airplane was purchased by Salair in March 1988 and used for international nonscheduled cargo flights from Miami, Florida, and the Dominican Republic. During that time, it was maintained at a Salair maintenance base in Borinquen, Puerto Rico. According to maintenance record entries, the airplane underwent a "C-3" check on July 19, 1995. Because of a fatal accident involving another Salair Convair 340 on June 27, 1995, Salair was banned from further flights by the government of the Dominican Republic and the airplane was flown to Miami after the accident.

On December 12, 1995, the airplane was then ferried to Deer Valley. Salair had intended the airplane to be ferried to Spokane on that day, but adverse weather had prevailed. Weather conditions to Deer Valley were adequate and fuel prices were attractive. The airplane remained at Deer Valley until the day of the accident, and received maintenance on the transponder, which had been malfunctioning. Maintenance record entries indicate that the airplane had accumulated a total of 8,642 hours of flight time at the time of the accident, and 21 hours since the C-3 check.

Maintenance record entries also indicate that the left fuel quantity cockpit gauge was removed and replaced with a serviceable unit on April 5, 1995, because it was "stuck indicating 2100." The right fuel quantity cockpit gauge was also removed and replaced during the C-3 check because of sticking. The left engine fuel boost pump cockpit switch was removed and replaced on June 7, 1995, for use in another Convair 340. Both engine-driven fuel pumps were removed and replaced with overhauled units during the C-3 check. Both electrically-driven fuel boost pumps were installed in the airplane in 1991 with no further maintenance actions noted.

Previous Flight.

The Safety Board contacted the ferry pilot who flew the accident airplane to Deer Valley on December 12, 1995. According to the pilot, no problems with the airplane were noted except for a radio transponder malfunction.

PERSONNEL INFORMATION

First Pilot.

The first pilot, age 40, held an FAA airplane transport pilot certificate with ratings for single engine land, single engine sea, multiengine land, and instrument airplanes. He was type rated in Douglas DC-3, Convair 240, 340, and 440 airplanes. The pilot reported that he had accumulated a total of 5,194 hours of flight time, including 4,275 hours in multiengine airplanes as pilot-in-command, 294 hours in simulated and actual IMC, and 817 hours in type. During the 90 days previous to the accident, the first pilot had reported a total of 32 hours of flight time, including the 5.5 hours in type that he had accumulated during the accident flight. The pilot was issued an FAA First Class Medical Certificate on October 10, 1995, with the limitation that he "must wear corrective lenses."

Second Pilot.

The second pilot, age 25, held an FAA commercial pilot certificate with ratings for single engine land, multiengine land, and instrument airplanes. He was also an certified flight instructor in single engine airplanes. He did not hold any type ratings, and the accident flight was his first flight in a Convair 340. The pilot reported that he had accumulated a total of 550 hours of flight time, including 54 hours in multiengine airplanes, and 4.4 hours in actual IMC. During the 90 days previous to the accident, the second pilot had reported a total of 31 hours of flight time, including 10.2 hour in multiengine airplanes and the 5.5 hours he accumulated in type during the accident flight. The pilot was issued an FAA Second Class Medical Certificate on July 11, 1995, with the limitation that he "must wear corrective lenses." The second pilot was hired by Salair about three weeks prior to the accident.

METEOROLOGICAL INFORMATION

According to a meteorological surface observation taken at the Spokane International Airport about three minutes after the accident, the following conditions prevailed: cloud ceiling 600 feet broken above ground level, visibility 10 statute miles, temperature 20 degrees F, dewpoint 18 degrees F, winds from 030 degrees magnetic at 7 knots, with no precipitation or restrictions to visibility. Dark night conditions prevailed at the time of the accident.

WRECKAGE AND IMPACT INFORMATION

The airplane wreckage was examined at the accident site one day after the accident on January 5, 1996. The airplane came to rest on level terrain in an open field along the extended centerline of Runway 3 and about one mile from the runway threshold. The wreckage was distributed along a magnetic bearing of 030 degrees. The wreckage path was measured to be about 250 feet in length.

The initial ground scar led to a raised berm located about 100 feet from the beginning of the scar. Portions of the right and left main landing gear doors, left aileron, and left skin pieces were located on this berm. Evidence of a disintegrated left wing and left fuel tank was found distributed from the berm to the main wreckage area. No evidence of fuel spillage was found in this area. The main wreckage area included both engines, the right wing, fuselage and empennage. The left wing had been sheared off about six feet from its fuselage interface.

No evidence of fire, explosion, or in-flight breakup was found. All primary and secondary flight control surfaces were accounted for at the accident site. No evidence was found to indicate a flight control deficiency. Preimpact flap positions could not be determined. The main landing gear was found in the retracted position.

An examination of the left engine did not reveal any evidence of catastrophic failure. A small amount of a clear blue liquid that resembled the color, smell and viscosity of 100 low lead aviation fuel was drained from the carburetor inlet line. An examination of the fuel filter revealed that it was free of contamination or blockages.

An examination of the right engine did not reveal any evidence of catastrophic failure. About a cup of a clear blue liquid that resembled the color, smell and viscosity of 100 low lead aviation fuel was drained from the carburetor inlet line. An examination of the fuel filter revealed that it was free of contamination or blockages.

The right wing had separated from the fuselage and was found lying parallel to the longitudinal axis of the fuselage. The root of the wing was raised about 24 inches above the

ground, and the tip of the wing was resting on the ground. The fuel cell within the right wing was not compromised. About 125 gallons of fuel was pumped out of the right wing tank.

An examination of the fuel outlets for both wings, as well as the fuel baffles, did not reveal evidence of malfunction or blockage.

An examination of the cockpit revealed the following switch positions on the overhead fuel panel:

Right fuel tank valve switch : CLOSED (switch guard open) Left fuel tank valve switch: CLOSED (switch guard open) Crossfeed valve switch : OPEN (switch guard open) Emergency Power Off switch: NORMAL (switch guard closed)

The pilot stated that the cockpit had been secured prior to egressing the airplane. Both the portable breathing oxygen bottle and airplane's oxygen supply had been depleted.

MEDICAL AND PATHOLOGICAL INFORMATION

Both pilots voluntarily submitted to a drug screen test immediately after the accident at the request of Salair management. Specimens were collected at Deaconess Medical Center in Spokane and were analyzed by Virginia Mason Medical Center in Seattle, Washington. According to the reports of results of the drug screen (attached), negative results were reported for both pilots.

TESTS AND RESEARCH

Additional detailed examinations and functional tests of the airplane's fuel system components were performed by the Safety Board at facilities operated by Discount Aircraft Salvage in Deer Park, Washington, on February 21, 1996, and April 25, 1996.

Fuel Boost Pumps.

Both fuel boost pumps were powered up from a 24-volt battery and were able to provide positive fuel flow with no deficiencies noted.

Engine-driven Fuel Pumps.

The left engine-driven fuel pump was spun with a hydraulic power tool and was able to pump one gallon of fuel in 18 seconds with no deficiencies noted.

The right engine-driven fuel pump was seized; however, its frangible drive coupling was found intact. The aft backing plate of the pump was missing and the four bolts that held the plate to the pump housing were fractured almost flush with the housing. An examination of the pump was performed by the Safety Board's Materials Laboratory Division. According to the metallurgist's factual report (attached):

Visual examination of the bolt fractures...disclosed no evidence of preexisting cracking. The lower 2 bolt fractures were damaged by post fracture mechanical smearing. However, deformation of the bolt shafts within the housing were consistent with the face plate moving right (outboard) relative to the housing. The upper bolts contained fracture surfaces and deformation consistent with shear fracture as if the face plate was moving outboard relative to the housing. The missing face plate allowed for examination of the exposed vanes in the pump. One of the vanes was out of its slot and moved aft. This out of slot vane was wedged between the internal bore of the pump and the inboard surface of a

diametrically opposite vane that was still within its slot. Such wedging appeared to have caused seizure of the pump vanes from rotation within the housing.

Fuel Boost Pump Switches.

The circuit continuity of both left and right cockpit boost pump switches were tested with a hand-held Multimeter while installed in the airplane. Continuity from both switch circuits was intermittent. The switches were removed and disassembled. A minute amount of a grayish-black material was found on the switch contacts and inside the switch housing. A chemical analysis of a sample of the material was performed (report attached). Results were inconclusive; however, it was determined that the material was not nicotine.

The switches were then reassembled and tested at facilities operated by the Honeywell Micro Switch Division in Freeport, Illinois, with voltage and current values that are similar to those generated by an aircraft electrical system. Results of the test (attached) indicate that the switches operated with no anomalies noted. It was determined that the left switch was manufactured in April 1956 and the right switch was manufactured in April 1963.

ADDITIONAL INFORMATION

Previous Accidents.

Salair was involved in two previous fatal accidents during a two-year period preceding this accident. The first fatal accident occurred on March 18, 1994, at the Spokane International Airport (NTSB Accident Case No. SEA94FA085). The accident involved a Salair Douglas DC-3C that collided with terrain shortly after takeoff. The collision occurred after the second pilot reported that the flight was returning to the airport with the right engine shut down. The Safety Board ruled that the probable cause of the accident was "the failure of the pilot-in-command to maintain airspeed." The Board also ruled that the contributing factors to the accident were "[right engine] cylinder fatigue, dark night and stall encountered."

The second fatal accident occurred on June 27, 1995, in the vicinity of La Romana, in the Dominican Republic (NTSB Accident Case No. MIA95RA162). The accident involved a Salair Convair 340 that had departed from Santa Domingo, Dominican Republic, on an international, nonscheduled cargo flight. After departure, the crew reported that they were experiencing problems and were returning to Santo Domingo. The airplane's left engine failed and caught fire. The airplane impacted terrain and was destroyed. The accident was investigated by Dominican Republic Aviation Authorities. According to their report, the cause of the accident was the flightcrew's failure to properly utilize emergency procedures, and the mechanical failure of the left engine.

Military Safety Supplement.

On April 26, 1972, the United States Air Force (USAF) issued a Safety Supplement (attached) to modify the flight manual for the C-131D and C-131E aircraft. According to Tracor Flight Systems, these military aircraft are similar to the Convair Model 340/340 type aircraft. The purpose of the safety supplement was "to provide additional information concerning the fuel system and cross-wind landing." According to the Safety Supplement:

The investigation of a recent...incident revealed that fuel starvation to the low wing engine can occur during prolonged cross control, cross-wind approaches. Flight tests during similar controlled conditions confirmed

that with as much as 900 lbs [150 gallons] per tank...fuel remaining, bank angles of 15 degrees or more in any cross control situation will cause fuel starvation in approximately one minute.

The Safety Supplement requires that the following notes and warning be added to the C-131D and C-131E flight manuals:

NOTE

Due to the location of the wing fuel outlets, fuel starvation of an engine could occur during cross control flight with less than a full load of fuel.

WARNING

Extreme wing-low cross control attitudes for prolonged periods of time can cause fuel starvation of the low wing engine due to fuel flowing away from the wing fuel outlet. Tests have shown that with as much as 900 pounds per tank (1800 pounds total) fuel remaining, bank angles of 15 degrees or more in any cross control situation will cause fuel starvation in approximately one minute.

This information was not contained in the Salair Convair 340 Airplane Operating Manual or any Salair checklists or documents. No evidence was found to indicate that the information was disseminated to other Convair operators. According to Tracor Flight Systems, the operation of USAF aircraft and the information contained in the USAF technical order is governed and controlled by the USAF. The information contained in the USAF technical orders is not the same as that in an FAA approved flight manual. If Convair was never officially notified of the accident, or requested to participate in the investigation or informed of the cause, it would have been impossible for them to disseminate any information regarding the accident to any civilian operator.

Convair 640/340D Fuel System Limitations.

According to Tracor Flight Systems, the Convair Model 640 (also designated as the 340D) has a similar airframe as the Convair 340, with some changes in the fuel distribution system. The Convair 640 is a conversion (via FAA Supplemental Type Certificate) of the Convair 340/340 which installed Rolls-Royce Dart MK 542-4 turboprop engines in place of the Pratt & Whitney piston engines.

An examination of the FAA Approved Flight Manual for the Convair 340D revealed the following:

When operating with very low fuel quantity during abnormal flight conditions, it may be possible for the fuel tank outlets to become uncovered resulting in air ingestion into the engine fuel system

Air in the engine fuel system can cause engine power fluctuations or flame out.

1. In turbulent air with very low fuel and both engines operating, open the crossfeed valves and leave both boost pumps "on." low fuel during single engine operation, open both boost pumps "on." Keep wings as level as possible.
2. When operating with very low fuel during single engine operation, open both boost pumps "on." Keep wings as level as possible.

This information is not contained in any Convair 340 manuals.

Wreckage Release.

The aircraft wreckage was released to Mr. Gary Valkenaar, Spokane, Washington, on August 12, 1996. Mr. Valkenaar is representing the registered owner of the airplane.

Pilot Information

Certificate:	Airline Transport	Age:	40, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land; Single-engine Sea	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 1 Valid Medical--w/ waivers/lim.	Last FAA Medical Exam:	10/10/1995
Occupational Pilot:	Last Flight Review or Equivalent:		
Flight Time:	5194 hours (Total, all aircraft), 817 hours (Total, this make and model), 4962 hours (Pilot In Command, all aircraft), 33 hours (Last 90 days, all aircraft), 21 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Convair	Registration:	N358SA
Model/Series:	340 340	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Transport	Serial Number:	153
Landing Gear Type:	Retractable - Tricycle	Seats:	2
Date/Type of Last Inspection:	07/19/1995, Continuous Airworthiness	Certified Max Gross Wt.:	48000 lbs
Time Since Last Inspection:	21 Hours	Engines:	2 Reciprocating
Airframe Total Time:	8642 Hours	Engine Manufacturer:	P&W
ELT:	Installed	Engine Model/Series:	R-2800-CB16
Registered Owner:	SALAIR, INC.	Rated Power:	2400 hp
Operator:	SALAIR, INC.	Operating Certificate(s) Held:	Supplemental
Operator Does Business As:		Operator Designator Code:	SLIA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument Conditions	Condition of Light:	Night/Dark
Observation Facility, Elevation:	GEG, 2372 ft msl	Distance from Accident Site:	1 Nautical Miles
Observation Time:	1856 PST	Direction from Accident Site:	30°
Lowest Cloud Condition:	Unknown / 0 ft agl	Visibility	10 Miles
Lowest Ceiling:	Broken / 600 ft agl	Visibility (RVR):	0 ft
Wind Speed/Gusts:	7 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	30°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30 inches Hg	Temperature/Dew Point:	-7° C / -8° C
Precipitation and Obscuration:			
Departure Point:	DEER VALLEY, AZ (DVT)	Type of Flight Plan Filed:	IFR
Destination:	(GEG)	Type of Clearance:	IFR
Departure Time:	1420 MST	Type of Airspace:	Class B

Wreckage and Impact Information

Crew Injuries:	1 Minor, 1 None	Aircraft Damage:	Destroyed
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Minor, 1 None	Latitude, Longitude:	

Administrative Information

Investigator In Charge (IIC):	JEFFREY B GUZZETTI	Report Date:	05/23/1997
Additional Participating Persons:	DAVID AVEY; SPOKANE, WA BRUCE SALERNO; SPOKANE, WA LARRY DAVIS; MOJAVE, CA		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinquiry@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.nts.gov/pubdms/ .		

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).